Implementing Mobile Portfolio Application in EFL Classes: Efficiency for Fostering Reflective Thinking, Directed Motivational Currents (DMCs), and Cognitive Learning

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Article info	Abstract
	Today, traditional passive learning and note taking are less effective for students adapting to modern life skills. Mobile portfolios, versatile learning tools with numerous benefits, are finding their way into educational domain in promoting active learning. This study explored the impact of the present researchers' designed mobile portfolio (called Class Mass) on students' reflective thinking, directed motivational currents (DMCs), and cognitive learning. This study was performed in two ninth-grade English classes of a state-run female junior high school via a quasi-experimental research design. In terms of instruments, the following scales were utilized: reflective thinking inventory (measuring four distinct components), DMC disposition questionnaire, and cognitive learning scale. The results of independent samples t-test and multivariate analysis of variance (MANOVA) demonstrated the effectiveness of using the mobile portfolio application on learners' three components of reflective thinking, DMCs, and cognitive learning. The study suggests that teachers should recognize the advantages of employing mobile portfolios as effective tools for learning and assessment to foster their students' goal-oriented inspirational surge, encourage active participation, and provide positive feedback and clues on how to improve their learning. ***Keywords***: cognitive learning, directed motivational currents, mobile portfolio application, reflective thinking

1. Introduction

One of the generic missions of any educational venture is to offer education and learning prospects that are both inclusive and equitable in terms of quality and continue throughout an individual's life (Sultana et al., 2020). To attain lifelong learning, learners need to contemplate their learning encounters and convictions and effectively oversee their learning throughout their lifetimes (Hargreaves, 2005). One of the essential competences for the lifelong learning is reflection (Ghanizadeh, 2017). It develops students' learning autonomy and develops their collective and individual awareness and deep thinking that can be decisive in attaining higher levels of cognition and learning (Roger, 2001).

Reflection or reflective thinking is a method of cognitive processing that can be used to achieve a purpose or some predicted outcome (Clegg et al., 2002). Thinking, particularly reflective thinking, is essential to both teachers' and students' learning. The concept of reflective thinking refers to thinking about what we do after or during work. This stands as a primary cognitive skill that steers students towards scrutinizing and assessing their educational journey and assist them observe their progress from incompetent to competent (Ghanizadeh & Jahedizadeh, 2017b).

Prior to 20th century, John Dewey was the pioneer in reflective thinking conceptualization. Dewey (1993) designated reflective thinking as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the conclusion to which it tends" (p. 9). This form of thinking encompasses the capacity to utilize observations and past experiences to inform decisions about both historical events and current situations, ultimately guiding and shaping future actions (Antonio, 2020). Loughran (1996) supplemented reflective thinking with phases such as assertion, hypothesis, inference-making, and assessment.

One of the tools which can stimulate and foster reflection in educational systems is reflective-inspired approaches such as portfolios or journals (Ghanizadeh et al., 2020). The term portfolio is etymologically stemmed from the Latin words "portare" (to carry) and "folium" (paper, sheet) which were combined as "portafaglio" in Italian and then in English as "portfolio" (İşman et al., 2015). As Genesee and Upshur (1996) maintained, a portfolio is a focused assembly of learners' learning activities that portrait their attempts, development, and achievement in any learning endeavor. Learning portfolio is a dynamic, evidence-based tool engaging learners in the constant process of deep thinking and collaborative reflection of their knowledge acquisition (Zubizarreta, 2009).

In recent years, with the appearance and expansion of mobile learning, educators and researchers have shown great interest in finding portfolio systems that are mobile-compatible, and consequently available and

trustworthy (Martí & Ferrer, 2012). Using mobile devices (e.g., mobile phones, personal digital assistants [PDAs], and tablet PCs) at anytime and anywhere make them as fundamental tools for formal and informal language learning and language assessment (Kukulska-Hulme & Shield, 2008). In language education domain, current development, which integrates language learning with digital technology, is referred to mobile assisted language learning (MALL). MALL devices can improve interactivity, collaboration, and engagement in different learning activities and make learners more autonomous about what, where, when, and how they will learn (Kukulska-Hulme, 2009).

E-portfolio as a learning support tool emphasizes the learning process, experience, and professional development in order to develop language achievement (Mohamad et al., 2015). It is also used as a convenient assessment tool for higher education centers that tend to execute partial or inclusive synchronous online system (Kusuma & Waluyo, 2023). E-Portfolios can also affect motivational and emotional aspects of language achievement (Ghanizadeh et al., 2020). Motivation is an important point in language education because it is one of the most common terms used by teachers and students to describe the reasons for success or failure in learning (Nassirdoost & Mall-Amiri, 2015). As Dörnyei and Chan (2013) mentioned, without enough inspiration even competent learners cannot attain mastery-oriented objectives.

One of the recent developments in L2 motivation is the conceptualization of Directed Motivational Currents (DMCs) (Ghanizadeh & Jahedizadeh, 2017a). DMC as a motivational phenomenon has recently evolved in educational psychology by Muir and Dörnyei (2013). It refers to "a notable rise in students' motivational disposition, resulting from the equilibrium among individual, environmental, and temporal elements, which encourages students to set and persist in attaining constructive mastery-oriented goals (Dörnyei et al., 2014).

In the Iranian formal EFL context, it seems the compulsory nature of language education as well as the adaptation of traditional teaching and assessment techniques tend to make students demotivated and disengaged in the course of EFL learning (Ghanizadeh & Rostami, 2015). Integrating innovative digital technology to class instruction and activities appears to resolve part of this adverse scenario (Takahashi, 2013). Inspired by this contention, this study tried to investigate the potential of mobile-portfolio applications to reinforce students' effective learning by promoting reflective thinking and cognitive learning as well as enhancing their motivation in learning process. Reflective thinking refers to making use of experiences and observations that have happened in the past or are happening now to better control and direct future activities (Antonio, 2020). Cognitive learning is the extent to which learners attain accurate, meaningful, and analytical

comprehension of the lessons which is directly under the influence of teacher instructional and emotional behavior and practices (Gholamrezaee & Ghanizadeh, 2014). To do so, three research questions were formulated to attain the goals of present study:

1. Does the use of *Class Mass*, as a mobile portfolio application, have any significant effect on the constituents of Iranian EFL students' reflective thinking (habitual action, understanding, reflection, and critical reflection)?
2. Does the use of *Class Mass*, as a mobile portfolio application, have any significant effect on EFL students' DMCs?
3. Does the use of *Class Mass*, as a mobile portfolio application, have any significant effect on Iranian EFL students' cognitive learning?

2. Literature Review

2.1. E-portfolio

Electronic Portfolio, or e-portfolio, is a term that has many meanings and is used frequently. An electronic portfolio may refer to multimedia portfolio, electronic portfolio, e-folios, or webfolio, is similar to pen/paper portfolio, but the difference is in the media used to present and organize the portfolio artifacts (Kocoglu et al., 2008).

E-Portfolios have extra features in comparison with pen and paper portfolios as they have a wider context, archiving, link building and thinking, cooperation, reorganization, publication. They can also be employed among different groups such as individuals, student associations, regions and cities and social communities (İşman et al., 2015).

According to Barret (2000, as cited in Kocoglu et al., 2008), a portfolio developer uses different electronic technologies as e-portfolios in order to collect and organize artefacts in different formats. The e-portfolio uses electronic technologies to gather information from a wide range of media, including video, audio, graphics, and text, as well as hypertext links in order to do various activities like providing feedback, encouraging group work, learning in groups, retained creativity, etc. (Kocoglu et al., 2008).

Challis (2005) offers a more comprehensive definition as follow: an e-portfolio is the assembly of designated and organized information, accumulated for recording shows the growth of individual achievements, and is stored in the digital form, organized through applicable software, established via relevant multimedia, typically developed in a web setting, and resumed from a website, or transported via CD-ROM or DVD.

In fact, as a learning strategy, e-portfolio can be useful for learners as a "scaffolding approach to understanding and engagement" (Alexiou & Paraskeva, 2010, p. 3052), that have positive effect on self-directed learning

(Beckers et al., 2016; Ismailov & Laurier 2022). E-portfolios make learners to set personal goals according to their learning, establish real objectives, and identify their activities to achieve their individual goals (Ciesielkiewicz & Coca, 2013). They have also the potential to accelerate professional competence (Najaffard et al., 2024). According to Ghanizadeh et al., (2020), these can ultimately be considered as important and essential strategies for successful lifelong learning.

As assessment tools, e-portfolios have been found to influence various dimensions of learning and achievement, such as students' academic engagement and writing achievement (Pourdana & Tavassoli, 2022), and their self-efficacy and speaking improvement (Kusuma & Waluyo, 2023).

2.2. Reflective Thinking

The contemporary world has undergone a multitude of diverse and dynamic transformations, becoming notably intricate. This complexity has arisen due to the increased ease of access to a wide range of information, prompting individuals to continually reevaluate their course, pivot, and resolve issues at a faster pace (Antonio, 2020). One of the constant demands of education from teachers is to adhere to teaching methods and provide students with pertinent knowledge and lifelong skills to empower them in effectively navigating these intricate changes (Jerald, 2009). These crucial skills, often referred to as 21st-century competency, encompass deep thinking, discovery learning, problem-solving, collaboration, resourcefulness, and creativity. They are integral components of learning and innovation skills. Additionally, initiative and self-direction are key facets of media literacy skills and life and professional skills. Consequently, modern education faces the imperative task of nurturing these competencies in students, particularly within higher education (Geisinger, 2016).

Reflective thinking, which is related to critical thinking, is considered as one of the essential and permanent skills (Al-Husban, 2020). Reflective thinking means using experiences and observations that have happened in the past or are happening now to better control and direct our future activities (Antonio, 2020). Preparing learners and teachers to engage in deep reflection thinkers by educating them about constructive strategies through which they can ponder on their own academic achievement is one of the cumbersome missions of education in modern and digital world (Ghanizadeh et al., 2020). Hence, a primary objective for educators should be the creation of a productive learning environment that fosters a culture of reflection (Ghanizadeh, 2017). Teachers are required to make scientific concepts more credible and closer to real-world methods of science, as this develops students' reflective thinking skills (Antonio, 2020).

2.3. Directed Motivational Currents (DMCs)

Previous views on L2 motivation date back to many years ago. In 1959 in one study researchers believed that most studies of the second language had examined the concept of linguistic aptitude as an explanation for language success (Gardner & Lambert, 1959, as cited in Ghanizadeh & Jahedizadeh, 2017a). Over the past decades, most research in second language teaching has focused on the concept of language learning motivation (Clément, 1980; Spolsky, 1988). Motivation plays a pivotal role in any human undertaking. The prevailing belief is that motivated individuals are inclined to dedicate greater time, energy, and persistence toward achieving their objectives. In recent decades, the field of motivation has been acknowledged as a crucial factor in the process of second language learning.

One of the latest advances in the area of L2 motivation is the notion of directed motivational currents (DMCs) (Dörnyei et al, 2015; Ghanizadeh & Jahedizadeh, 2017a; Muir, 2016). By combining DMC and vision, Muir and Dörnyei (2013) tried to offer a powerful tool to guide learners to their impossible goals (Muir & Dörnyei, 2013). Vision is defined by them as an aspect of the L2 motivational Self-System and an internal depiction of the sensory involvement of the prospective objectives. The role that vision and the senses play in our current focus are motivations to learn a second language by promoting clearer mental imagery in the situations ahead (Dörnyei & Chan, 2013). In this framework, DCM is defined as a robust motivational rise, arising from the configuration of a bunch of individual, domain-specific, and temporal elements, that can support individuals in achieving self-directed goals (Dörnyei et al., 2014).

Three relevant components for DMCs are: goal/vision-orientedness, the leading constructive organization, and favorable perceptions (Dörnyei et al., 2016, as cited in Zarrinabadi & Khajeh, 2021). In this motivational framework, the most pertinent characteristic of a DMC lies in its directedness, which should be in line with the personal mastery-oriented goals. It implies that this inspirational surge has a directional characteristic and a clear ultimate objective such as being a proficient L2 learner and user (Dörnyei et al., 2015; Muir, 2016). Goal-orientation and a clear vision, which refer to the fact that DMCs have a defined objective and vision, are indispensable for triggering DMC. They help individuals use their energy purposefully and strive to achieve their goals (Dörnyei et al., 2014; Muir & Dörnyei, 2013).

It should be noted that, despite the fact that a plethora of studies explored the benefits and potential of portfolios, in particular e-portfolios, in enhancing students' successful functioning (e.g., Beckers et al., 2016; Ciesielkiewicz & Coca, 2013; Ghanizadeh et al., 2020; Ismailov & Laurier, 2022; Kusuma & Waluyo, 2023; Pourdana & Tavassoli, 2022), they failed to recognize the need for developing mobile-operated and contextualized

portfolios, designed specifically in line with the needs and characteristics of the population under study. Almost all the studied reviewed made use of commercially available platforms and models for creating and sharing portfolios. To address this research gap and to meet the objectives of the present study, we devised a mobile application for documenting and analyzing students' generated portfolios. The involvement of students with this pedagogic-technological scaffolding was explored in terms of the promotion of their reflective thinking, DMCs, and cognitive learning.

3. Method
3.1. Participants

The sampling frame was limited to one junior high school in Chenaran, a small town in north east of Iran. In this study, 50 teenage female students aged fourteen and fifteen, were selected according to a convenience sampling. The participants of control and experimental groups were in two separate classes, each comprising 25 students. The common denominator of all participants was that English was not their native or second language, and they received English as a course of study at the school. Hence, they were more eager to participate in this research study. Indeed, all of them participated actively without any obligation. After a brief explanation of the purpose of the research, in order to ensure that both control and experimental groups were homogeneous, all of them received the Reflective Thinking Questionnaire (RTQ), DMC Disposition Questionnaire, Cognitive learning inventory, as well as language proficiency test.

3.2. Instruments
3.2.1. Reflective Thinking Questionnaire (RTQ)

The RTQ by Kember et al. (2000) was used to pinpoint reflective thinking, consisting of 16 items evaluating four dimensions of reflective thinking: habitual action (HA), understanding (UND), reflection (REF), critical reflection (CREF). These four components exclusively measure four separate aspects of thinking, ranging from the lowest order side of reflective thinking (HA) to the highest level (CREF). As Kember et al. (2000) maintained, the scores of each RT type should be represented separately, as each measure a different aspect of RT, which cannot be added up. HA is the information which has already been learned and turned into automatic action via repetitive practice. UND or thoughtful action uses current information with no apparent evaluation to comprehend and learn something. It is also defined as understanding with no connection to other circumstances. FER is the internal exploration and evaluation of a circumstance, which is derived from personal experiences and leads to meaningful perspectives of the issues. CREF

is the representation of a more advanced level of RF, which enables us to adapt and modify our existing meaning structure.

Leung and Kember (2003) reported reliability scores fluctuating from .58 to .74 for these four RTQ subscales, with items rated on a seven-point scale from 1 to 7. In this study, the Persian version of the scale validated by Ghanizadeh and Jahedizadeh (2017b) was utilized. According to the research findings, the assessment displayed satisfactory validity ($\chi2 = 322.21$, df = 121, RMSEA=. 068, GFI = .89, NFI = .90, CFI = .90) and a reliability score of .81. Table 1. Portraits the four subscales.

Table 1
Four Factors of Reflective Thinking Along With the Sample Items

Factors	Sample Item
Habitual action	I can perform certain activities without conscious thought.
Understanding	Comprehending the material taught by the teacher is essential for me to carry out practical tasks.
Reflection	Occasionally, I challenge how others approach tasks and attempt to brainstorm more effective alternatives.
Critical reflection	This course has led me to modify my usual approach to tasks.

3.2.2. DMC Disposition Questionnaire

The study assessed student Directed Motivational Currents using the Persian version of the DMC Disposition Questionnaire, initially generated and confirmed by Muir (2016) and later translated to Persian and revalidated in Iranian context by Ghanizadeh and Jahedizadeh (2017a). The DMC Disposition Questionnaire is a dynamic web-based scale with 12 statements measuring easy flow (8 items) and challenge (4 items), using a 5-point Likert scale. It has strong internal consistency (Cronbach's Alpha = .84). The validity indicators of the Persian version are as follows: $\chi2 = 223.45$, df = 106, RMSEA= 0.06, CFI = 0.91, GFI = 0.90, NFI = .90. The Cronbach's alpha estimate for both dimensions of the Persian scale was .98 for 12 items.

3.2.3. Cognitive Learning

Cognitive learning was measured with the Richmond et al. (1987) two-item learning loss measure. Learning loss was computed by subtracting the scores of two items (on a scale from 0 to 9) answered by students. Participants were informed that "0" equated nothing and "9" implied that they learned over and above the other courses. This would make the obtained scores, ranging from 0 to 18. Richmond et al. (1987) substantiated the reliability and validity of the measure in multiple studies. In the followings, the items are represented:

1. How much do you feel you have learned with your current teacher?
2. How much do you feel you would have learned if you had had the ideal teacher?

3.3. Procedure

In the present research, a quantitative method with a quasi-experimental design was used. To investigate the impact of mobile portfolio applications on reflective thinking, DMC, and cognitive learning, the experimental and the control group in two different classes in the same grade were utilized. To ensure that these two groups were homogenous regarding the three variables mentioned above, a pre-test was held through associated questionnaires. These variables were re-assessed in the post-test to prove the effectiveness of the treatment (mobile portfolio applications) in learners' reflective thinking, DMCs, and cognitive learning. To clarify the procedure of questionnaire collection and the purpose of the study, they received a guarantee that their responses and personal details would be kept confidential and anonymous.

To ensure the homogeneity of the two groups concerning their proficiency level, a Nelson test was used. It contained two modules of vocabulary (80 multiple-choice items), and reading comprehension (five passages), with the allotted time of 45 minutes. Due to time constraints, a sample of items were randomly selected, 30 multiple-choice items and two passages. The rationale behind selecting Nelson test was that given that the participants were selected from junior high school, their proficiency level could not be determined via more widely-used tests of English proficiency such as TOEFL or IELTS. Another reason lies in acceptable reliability and validity indicators of Nelson test, which have widely been demonstrated in previous research (Malmir & Aghazamani, 2019).

The participants of the experimental group installed a new researcher-design version of the portfolio application, which was designed specifically for this research study in order to record their perceptions, feedback, and reactions to each session and their learning; while, the control group continued the traditional way of teaching method, which was teacher-centered instruction. Collecting data from the experimental group began in the second semester during about two and a half months (January 2022 to March 2022) and was designed in ten sessions of about 60 minutes.

3.3.1. Treatment

Before the process began, the purpose of the portfolio was defined for the participants so that the researcher could better guide the individual training and learning process. The same teacher taught both the control and experimental classes, and the material that was taught to both groups was the same, including different activities such as conversation, grammar, pronunciation, and listening that were included in the book *Prospect 3* of grade 9 in the junior high school.

At the initiation of the course, the participants of the experimental group were asked to install a new research-designed portfolio application namely *Class Mass*. Each student had a username and password that made it possible for the teacher to create an individual portfolio for each learner in order to upload any content (like photo, voice, video, audio, text, and PDFs) during the research time. By creating individual portfolios, students were allowed to look through their work, reflect on their development, and feel secure about their portfolios.

Class Mass as a mobile portfolio app, provided facilities to students that made it practical and enjoyable for students. Students could share their pre-prepared content with other friends by selecting the option to submit content to the public page and benefit from their comments and suggestions to improve their work. They could also choose to submit only to their teacher by selecting the submit option for the teacher and benefit from their teacher's comments and tips to correct their problems, improve their activities, and prepare the best results for submission in the public group. *Class Mass* used their phone's internet connection to send their contents so they did not need SMS fees.

In the next phase, students were explained about the importance of having short-term and long-term goals and scheduling their time to organize daily activities and achieve their ultimate goal, which was passing the second semester exams successfully. They found it hard to find time to think when a work calendar is cluttered and full of diverse and unorganized activities. They also found that improving the quality of their activities and ideas required reflective thinking and structuring a practical lesson plan can support reflective thinking. Therefore, students were encouraged to have short-term planning in order to have enough time to assess their assumptions and be able to make connections between their activities, information, and ideas.

Short-term planning allowed students to stay focused, study effectively, and after succeeding in short-term goals, stay motivated throughout the course to achieve their long-term goals. They have learned to plan a schedule so that they can stick to it and also take responsibility for following it. They used their teacher's guidance and feedback when writing their weekly schedule. The students repeated the weekly planning of the lessons after the modification of the program and under the supervision of their teacher.

In each session, the different parts of each lesson, which were taught to both groups by the same teacher (as one of the researchers of the present study as well), including conversation, pronunciation, and grammar were reviewed again by the teacher or explained by the students voluntarily through social applications like Shad Platform (An Iranian platform) and in the general group. During the research period, the students volunteered to teach and explain the

different parts of each lesson, using their new and innovative ideas and methods, and after sending their pre-prepared materials to the relevant teacher via a private message up to the next session, the teacher correct their problems and send feedback to them and then materials were shared with the other students in the group through Class Mass in the related session. Then the other students asked their questions from the volunteer and expressed their opinion about their friend's explanation.

The participants' portfolio could include whatever they believed were important and useful for their learning process. Therefore, beside including representative samples of the materials, which were related to their course book such as its new words, grammar, language melody, tests and worksheets, their portfolio could also contain pictures, texts, music, story books, movies or other materials that they used or saw in their environment, which were interesting or had meaning for them. In fact, recording various content in their real world, or different important and useful materials from various sources other than their own school textbook in their portfolio, helped participants reflect on what they believed was important for them as learners and individuals. Some snapshots from different materials that participants thought were interesting and useful for their learning English are shown in Figure 1.

Figure 1
Some Screenshots of Class Mass
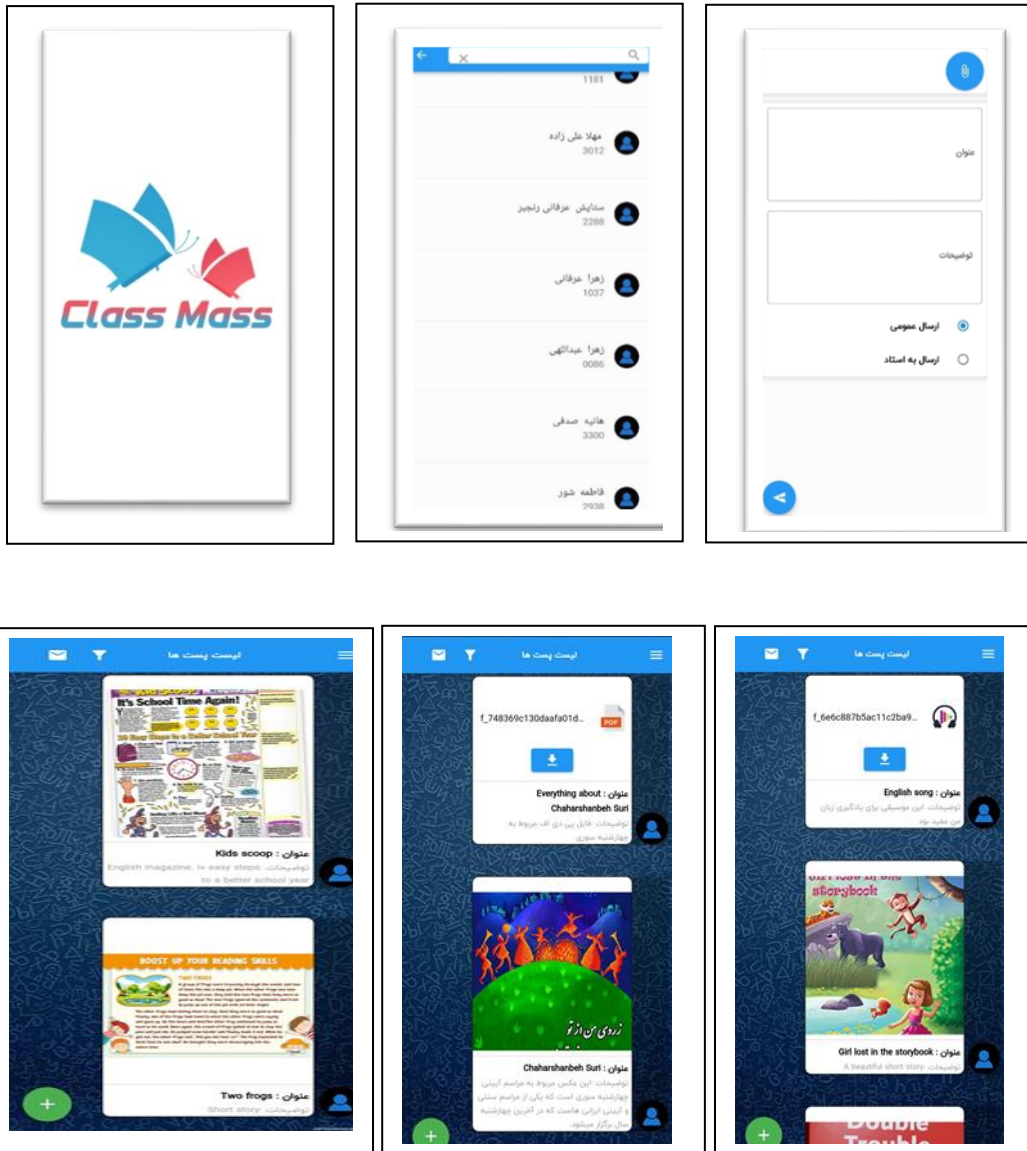
At the end of each session, after teaching the relevant materials and answering the students' questions, some pre-designed questions were provided to the students according to the content of each lesson to assess the student's learning and achievement.

3.4. Data Analysis

To analyze the quantitative data in this study, SPSS version 26 was utilized. To examine significant difference between control and experimental groups in pretest and posttest about their DMC level and their cognitive learning, separate independent samples *t*-tests were utilized. To investigate significant differences concerning reflective thing components, multivariate analysis of variance (*MANOVA*) was run.

4. Results and Discussion

4.1. Results

To assess if there is a significant disparity in language proficiency levels across the control and experimental groups before the study, an independent samples *t*-test was conducted. For all *t*-tests in this study, the Levene's test of equality of variances was checked, for which the *p*-value higher than 0.05 suggests homogeneity of variances. The findings indicated that there is no statistically significant distinction in the language proficiency level of the two groups (t =-1.27, p =.21). In simpler terms, both groups had similar language proficiency levels before starting the experiment.

To confirm the homogeneity of participants of the two groups regarding their RT level, we conducted *MANOVA*. We established four dependent variables: HA, UND, REF, and CREF, while the independent variable was the group (control and experimental). We conducted preliminary assumption tests to assess the hypothesis of running *MANOVA*. Fortunately, no significant violations were found. The results showed that there was no statistically significant disparity between in the combined dependent variables (F =.41, p = .80, Wilks' Lambda = .95) in the two groups. Two other independent samples *t*-test were performed for DMC and cognitive learning. It was revealed that there were no statistically significant disparities between control and experimental classes in terms of their DMC level (t = -.71, p = .48) as well as their cognitive learning (t= .96, p = .39).

To investigate the effect of the mobile phone application technique on students' RT, the mean scores of RT dimensions were first calculated in the two classes, the indices of which are exhibited in Table 2.

Table 2
Descriptive Indices of RT in Posttest

	Groups	Mean	Std. Deviation
HA.post	Control group	10.65	1.38
	Experimental group	11.20	1.90
	Total	10.92	1.67
UND.post	Control group	12.70	1.78
	Experimental group	14.40	.88
	Total	13.55	1.63
REF.post	Control group	11.45	1.23
	Experimental group	16.05	1.31
	Total	13.75	2.64
CREF.post	Control group	10.30	1.68
	Experimental group	14.45	1.73
	Total	12.37	2.69

The calculations of *MANOVA* displayed in Table 3 demonstrated that there was a statistically significant difference the two groups statistically diverged on the combined dependent variables (RT): (F = 51.49, p = .000, Wilks' Lambda = .14). We then estimated effect size, the magnitude of which 0.85. According to Cohen's F (Cohen, 1992), it demonstrated robust impact. This entails that about 85 % of variance in RT is explained for by the mobile application technique employed in the second group.

Table 3
MANOVA Table of RT

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Square
Level	Wilks' Lambda	.14	51.49	4.00	35.00	.00	.85

To get which RT subfactor is influenced by the treatment to a greater extent, the follow-up analysis was performed (Table 4).

Table 4
MANOVA Table of RT Components

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Groups	HA. post	3.02	1	3.02	1.08	.30	.03
	UND. post	28.90	1	28.90	14.64	.00	.28
	REF. post	211.60	1	211.60	129.90	.00	.77
	CREF. post	172.22	1	172.22	58.88	.00	.61

As Table 4 demonstrates, this difference holds true just for UND, REF, and CREF, but not for HA. It demonstrates that the execution of the mobile phone application in the experimental group could enhance UND by up to 28 percent, REF for about 77 percent, and CREF for about 61 percent. As can be seen, the highest impact is exerted on REF.

To investigate the impact of the treatment on DMC, we ran an independent samples *t*-test. Table 5 displays the descriptive indices of the analysis.

Table 5
Descriptive Indices of DMC in Posttest

	Groups	N	Mean	Std. Deviation	Std. Error Mean
DMC. post	Control group	25	30.50	4.83	1.08
	Experimental group	25	43.95	3.83	.85

According to the table, the average DMC score in the experimental class is higher compared to that of the control class. To assess the statistical significance of this observed difference, we conducted an independent samples *t*-test on DMC, and the results are shown in Table 6. It is evident that the two groups significantly differ in their DMC levels.

Table 6
Independent Samples T-Test for DMC in Posttest

		Levene's Test for Equality of Variances		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
		F	Sig.					
DMC. post	Equal variances assumed	1.92	.17	-9.74	48	.00	-13.45	1.38
	Equal variances not assumed			-9.74	48	.00	-13.45	1.38

To examine whether the mobile phone application has any significant impact on CL, an independent samples *t*-test was run. Table 7 outlines the descriptive indices of CL level across the two groups: control ($M = 12.80$, *SD* $= 1.88$), experimental ($M = 15.55$, *SD* $= .24$).

Table 7

Descriptive Indices of CL in Posttest

	Groups	N	Mean	Std. Deviation	Std. Error Mean
Cognitive Learning. post	Control group	25	12.80	1.88	.42
	Experimental group	25	15.55	1.09	.24

We then ran an independent samples *t*-test to pinpoint the statistical significance of the above observed difference. Table 8 displays the *t*-test results conducted on CL. The findings reveal a significant difference between the two groups in terms of their CL (*t* = -5.64, *p* = .006). In simpler terms, the treatment applied in the experimental group had a significant impact on the CL of EFL students.

Table 8

Independent Samples T-Test for CL in Posttest

		Levene's Test for Equality of Variances		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
		F	Sig.					
Cognitive Learning. post	Equal variances assumed	2.13	.1	-5.64	48	.00	-2.75	.48
	Equal variances not assumed			-5.64	48	.0	-2.75	.48

4.2. Discussion

As mentioned before, the aim of this study, which was carried out by adopting a quasi-experimental design, was to investigate the role of mobile portfolio application in EFL students' reflective thinking, DMCs, and cognitive learning. The result of independent samples *t*-test and *MANOVA* showed the effectiveness of using mobile portfolio application on three components of students' reflective thinking (UND, REF, CRF), DMCs, and cognitive learning. In the followings, the yielded results are discussed in the light of theoretical contentions and empirical studies.

The first research question probed whether mobile portfolio application influence EFL students' reflective thinking. The analysis of the implementation of the mobile portfolio application in the post-test showed significant improvement in the experimental group.

In recent years, the emergence and development of mobile learning have led educators and researchers to show great interest in finding portfolio systems that are accessible, reliable, and highly mobile-compatible (Martí & Ferrer, 2012). Educational institutions have acknowledged e-portfolios as

valuable and efficient tools for learning so that learners can develop their thinking and take ownership of their own learning (Sultana & Liang, 2020). Due to the possibility of storage and access, students are able to use electronic portfolios to document and demonstrate their learning process at different times and places (Sultana & Liang, 2020).

This finding aligns with previous research, affirming the beneficial impact of e-portfolios on reflective thinking. As an example, Chau and Cheng (2010) verified the benefits of using e-portfolios to enhance students' independent learning through reflection and problem-solving. Other researchers pointed to the contribution of using e-portfolio to helping learners become more active, autonomous, self-regulated, and critical thinkers (Abrami et al., 2007, as cited in Ciesielkiewicz, 2019; Wang, 2007). Learners who use e-portfolio must construct their own version of knowledge, refine and reflect on their understanding, and share their learning experiences with peers and teachers actively (Shroff et al., 2011).

The second research question investigated the effect of mobile portfolio application on students' DMCs. The results verified this impact. As Apple and Shimo (2004, as cited in Axton, 2012) mentioned, portfolios tend to produce more learner satisfaction and enjoyment compared to other traditional modes, and as their study shows, portfolios create a more affirmative perception toward L2 learning. The rapid advancement of mobile technologies enables flexible access to a variety of learning resources, as well as new ways of learning and strengthening communication, regardless of time or place (Cheon et al., 2012, as cited in Sun & Gao, 2020). Using a mobile portfolio can also create the most important elements of DMCs put forward by Dörnyei et al. (2014) which is the inner target and the reaction of pleasure that leads to more incentive to reach the ultimate objective.

According to Read and Cafolla (1999), using an electronic portfolio makes students student-centered and regulated, leading to higher levels of motivation. It provides opportunities for students to be more engaged and interested in learning and provide an effective avenue for fostering motivation to learn (Ahn, 2004).

The third research question investigated the contribution of mobile portfolio application to EFL students' cognitive learning. The results indicated that the experimental group surpassed the control group in respect of cognitive learning. Previous studies in the Iranian EFL context have already attested to this finding. Studies by Pourdana and Tavassoli (2022) as well as Nassirdoost, and Mall-Amiri (2015) verified the contribution of portfolios to students' academic gains. Although these studies focused on particular language skills and components such as writing and vocabulary retention through the use of portfolio for assessment purposes, it appears the outcomes can generalize to

the whole learning process when they are generated by students for learning and metacognitive awareness purposes.

By using mobile technology, students can be situated in an authentic environment which enables them to observe and record real objects to learn from everyday life situations (Hwang & Shadiev, 2014). Interacting with real objects not only stimulates their imagination and contributes to meaningful output, but also enables constant and regular practice in the target language (Skehan, 1998). By doing so, the learners are actively engaged involved in language learning.

In sum, mobile portfolio not only help students improve their technology skills (Abrami et al., 2007), but also enhance their critical thinking and problem-solving skills by developing self-directed goals and self-assessment skills (Khikmatullo, 2020). In many e-portfolios, students can share their experience of learning a foreign language with other learners, providing an opportunity for them to share their ideas and peer feedback about each other learning.

5. Conclusion and Implications

The current study generally tried to evaluate the impact of mobile portfolio application on reflective thinking, DMCs, and cognitive learning of a group of Iranian EFL students. Based on the significant difference in the mean scores between the control and experimental groups, it can be verified that the use of mobile portfolio application has a positive effect on reflective thinking, DMCs and cognitive learning of English learners.

As we know, the world and consequently the educational system is moving from the physical world to the virtual world. Mobile educational facilities and technology can have a great contribution in the life and intellectual system of students. With the spread of technology across the educational spectrum, e-portfolios have come to be highly regarded as a tool for learning (Theodosiadou & Konstantinidis, 2015). It is maintained that the e-portfolio scheme has been uniquely suited for the digital era as a source of effective learning and assessment tools and a tool for building and managing students' own knowledge.

In summary, mobile portfolios serve as valuable learning tools, emphasizing the significance of information gathering and analysis in education. Students proficient in using mobile portfolios gather diverse materials from various sources and apply their insights and experiences for analysis. This is crucial for enhancing learning outcomes, given the constant, often contradictory, and overwhelming flow of information in modern society. Thus, the ability to comprehend and utilize information takes precedence over rote memorization. These diverse applications and advantages of mobile portfolios can inspire students to set meaningful learning goals and strive for mastery. In conclusion, based on the findings of the present study, mobile

portfolios hold the potential to enhance student learning, thinking, and motivation.

The current study can have several implications for English language teaching in classroom. It is generally recommended to educational policymakers and local administrators, and teacher trainers in particular should inform teachers about the positive effects of using mobile portfolios in English language classes and provide courses for them in order to teach them how to use mobile portfolio application properly in English language classes.

Furthermore, it will empower both teachers and students to augment their competencies across various contexts, enabling them to make more informed decisions and cultivate a positive self-assessment in their personal lives and future endeavors, ultimately enhancing their future performance. In particular, teachers are encouraged to use mobile portfolio application in order to plan teaching progress. It will help teachers and students to enhance their capabilities in different settings, as a result, they make more cognizant decisions with constructive verdicts about themselves, their individual lives, and their prospective performances and thereby improve their career functioning. Researchers contended that teachers who utilize reflective thinking tools enhance effective teaching and learning practices (Beckers et al., 2016; Khikmatullo, 2020). It is also contended teachers who employ innovative technologies in their classes appear to attain higher teaching competency and can contribute to their students' learning more effectively (Farzaneh et al., 2024; Kashanizadeh et al., 2024).

A number of pertinent limitations and delimitations might jeopardize the validity and generalizability of the results. First, as stated earlier, due to administrative constraints, the participants of this study comprised teenager girls who studied in a junior high school. In future studies, male and female students of different age groups can participate. Studying on the other age groups or male students or mixed classes may have different results. Second, the place of the present study was one state junior high school in a small city near Mashhad, in north east of Iran. Therefore, another recommendation is to repeat this study in other areas or in private schools or English language teaching institutes. The third recommendation is related to the method of this study, which was quantitative in nature. Future research can utilize mixed-methods approach to obtain students' feedback and perceptions towards e-portfolios. Other equally vital variables, whether metacognitive, cognitive, emotional, or attitudinal, should be studied in relation to e-portfolios. Technologically-speaking, for developing more advanced and smart mobile portfolios, a team of IT experts, educationalists, and software designers should collaborate in future research.

Acknowledgements

We would like to express our sincere gratitude to all who participated in this project and contributed to the successful completion of this study.

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